

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-177199

(43)Date of publication of application : 02.07.1999

(51)Int.Cl.

H05K 1/11  
H05K 3/00  
H05K 3/40  
H05K 3/46

(21)Application number : 09-335823

(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

(22)Date of filing : 05.12.1997

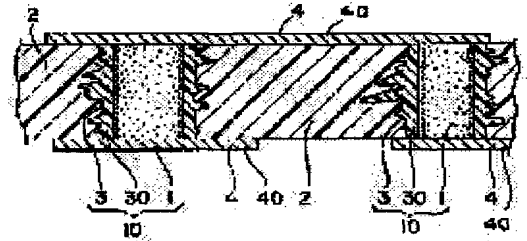
(72)Inventor : NISHIYAMA TOSAKU

## (54) PRINTED WIRING BOARD AND ITS MANUFACTURE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a printed wiring board constituting electronic devices and having improved reliability in electrical connection and a manufacturing method.

**SOLUTION:** When a via through hole 10 is made in a printed wiring board, a resin layer is made on the inner wall of the through hole and conductive paste is surely charged into the via hole. This can produce an extremely reliable via hole to prevent a disconnect in the via hole, an electrical breakdown caused by migration or the like even if a porous board is used.



JAPANESE

[JP,11-177199,A]

---

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS  
DESCRIPTION OF DRAWINGS DRAWINGS

---

[Translation done.]

**\* NOTICES \***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**CLAIMS**

---

[Claim(s)]

[Claim 1]A printed wired board comprising provided with a beer hall for electrode connection:

A breakthrough for beer halls which the above-mentioned beer hall formed in a substrate for an insulation which consists of a resin impregnation fibrous sheet.

this hole -- passing a resin layer which carried out covering formation, and this resin layer at an inner surface -- this hole -- a conductor by which restoration hardening was carried out inside.

[Claim 2]A printed wired board of claim 1 which is a heating and dissolving ingredient of resin of content in a resin impregnation fibrous sheet [ in / in the above-mentioned resin layer / breakthrough morphosis ].

[Claim 3]A printed wired board of claim 1 which the above-mentioned resin layer embeds resin liquid at a breakthrough of a resin impregnation fibrous sheet in breakthrough morphosis, and carries out that it is the remainder which punches a breakthrough to the resin curing object with the feature.

[Claim 4]A printed wired board, wherein the above-mentioned resin layer is a dry hardening layer of resin liquid adhering to a breakthrough for beer halls of a printed wired board in breakthrough morphosis.

[Claim 5]The printed wired board according to claim 1, 3, or 4 characterized by a filler of electric insulation containing at the above-mentioned resin layer.

[Claim 6]In a manufacturing method of a printed wired board which equipped with a beer hall for electrode connection a substrate for an insulation which consists of a resin impregnation fibrous sheet, A manufacturing method of a printed wired board forming the above-mentioned beer hall by forming a breakthrough for beer halls in this substrate for an insulation, and forming connected conductors in the breakthrough inside while covering formation of the resin layer was carried out and this resin layer had been placed between this breakthrough inner surface after that.

[Claim 7]A manufacturing method of the printed wired board according to claim 6 the above-mentioned breakthrough's carrying out laser radiation heating, forming in this substrate for an insulation, and forming the above-mentioned resin layer in a breakthrough inner surface by a heating and dissolving ingredient of a substrate for an insulation in the case of this breakthrough formation.

[Claim 8]The above-mentioned resin layer, nothing, a manufacturing method of the printed wired board according to claim 6 which fills up this breakthrough with resin, punches a breakthrough of a byway anew at the resin curing object, and is characterized by forming connected conductors in the resin layer inside after that after formation of the above-mentioned breakthrough.

[Claim 9]A manufacturing method of a printed wired board making resin liquid adhere to this breakthrough inner surface, carrying out post-dry hardening, forming a resin layer, and carrying out restoration formation of the connected conductors after that after formation of the above-mentioned breakthrough at a breakthrough.

[Claim 10]A manufacturing method of the printed wired board according to claim 6 with which a process in which the above-mentioned breakthrough is formed in a substrate for an insulation is characterized by using the CO<sub>2</sub> laser-heating processing method.

[Claim 11]The printed wired board according to any one of claims 1 to 8, wherein the above-mentioned resin impregnation fibrous sheet is a composite of a glass fibre or an aramid fiber, an epoxy resin or bismaleimide triazine resin, and \*\*.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to a printed wired board which has an inner beer hall used since electronic parts, such as semiconductor devices, such as CPU and a memory, other resistors, and a capacitor, a chip, etc. are carried, and a manufacturing method for the same.

[0002]

[Description of the Prior Art]Recently, as for the printed-circuit board, the degree of location of chips, such as a semiconductor device, a resistor, and a capacitor, etc. has become very high for much more miniaturization of a portable electronic device, and slimming down. Therefore, densification also of the printed wired board for mounting this must be carried out.

The multilayer printed wiring board was invented in order to cope with such the actual condition. The multilayer printed wiring board forms the conductor circuit in two or more substrates (inner layer circuit board) which constitute this beforehand, and enables mounting of high integration electronic parts by joining these substrates of each other.

[0003]In such a multilayer printed wiring board, it is necessary for the conductor circuit between each class to perform electrical continuity. Usually, in order to make it flow electrically [ inter-electrode / of each class ], the through hole is provided, current flows through this hole, and electric connection is made.

[0004]As how to provide this through hole, various methods, such as a method by plating and a method by conductive paste, are proposed and enforced. As a general manufacturing method about an all directions method, NC drill machine, a laser breakthrough processing machine, etc. perform breakthrough processing first, and the flow between layers is aimed at by plating in a breakthrough after that or putting in conductive paste etc.

[0005]For example, in the multilayer substrate shown in JP,7-115279,A, and its manufacturing method, the manufacturing method of this kind of printed wired board is indicated concretely. This method to the process of processing the breakthrough for beer halls into an insulation material layer, and this breakthrough A conductive particle. The process of being filled up with the conductive paste which consists of liquefied resin and a granular material hardening agent. It faces across both sides of the insulation material layer which has the beer in which it filled up with conductive paste by copper foil, Process the process bonded by thermo-compression and said copper foil, and the circuit pattern for inner layers is formed. A multilayer printed wired board is formed by a series of processes of the process considered as double-sided board composition, and the process which bond further the insulation material layer which has said beer hall, and said copper foil by thermo-compression by turns to the both sides or one side of this double-sided board, and processes said copper foil, forms a circuit pattern, and is made into multilayered constitution.

[0006]To a printed wired board, with electric nature these days A mechanical strength, The composite with which the synthetic resin resin board, and the textile fabrics and the nonwoven fabric of especially tough textiles, such as an aramid fiber, which carried out fiber reinforcement were impregnated in the epoxy resin etc. and which was especially made into the sheet shaped from the demand of the intensity in an elevated temperature was used, and it has contributed to the heat-resistant improvement in a wiring board. as such a multilayer wiring board — drawing 2 — two or more substrates (inner layer circuit board) 2 — the example of the multilayer printed wiring board which established the beer hall 10 in ... by the conductor 10 by conductive paste, and connected between the electrodes 4 and 4 to it is shown.

[0007]

[Problem(s) to be Solved by the Invention]However, in relation to that an insulating substrate is a sheet of the composite of the textile fabrics and the nonwoven fabric of textiles, and impregnating resin, and being the porosity in which a composite sheet contains a remains stoma in front of heat pressing further, when forming a breakthrough in an insulating substrate, it was easy to produce a defect in the wall. When processing a breakthrough into the insulating base material which comprises the above-mentioned composite, the wall of the breakthrough of the beer hall of a printed wired board became it coarse that a processing method was unsuitable, it plucked and there was a problem that galling etc. occurred. After the defect of these breakthroughs fills up a breakthrough with conductive paste, when heat pressing is performed, occasionally, The conductive paste which became fluid flows into a coarse inner wall of through hole, Carried out the contact short circuit to the conductor of the adjoining beer hall, or it became a cause of migration, or the conductive paste which should be embedded flowed out of the breakthrough, and decreased, and the technical problem that electrical link with a as sufficient beerhole conductor as the electrode between layers could not be taken was left behind after hardening.

[0008]For example, after forming the breakthrough 3 in the insulating substrate 2 by excimer laser, fill up the hole 3 with the conductive paste 1, subsequently put between drawing 3 by the copper foil 4, and the state at the time of carrying out heat pressing is notionally shown in it, but. In a processing method of high energy like excimer laser. the wall of a breakthrough processed in order for there to be nothing and to carry out decomposition evaporation in an instant also while the impregnating resin which constitutes the insulating substrate 2 of a composite fuses — skin — since it is rude, it can pluck, galling etc. occur in a wall part and a conductive paste flows into the portion, conductive paste will permeate and the lump part 16 will occur. Therefore, the technical problem that the loose connection part 17 is not only formed, but sufficiency of the conductive paste with which it filled up in the breakthrough was insufficient, and the migration resistance nature between beer halls got worse remarkably occurred.

[0009]Since the insulating base material was porosity as prepreg, since fine pores became unreserved as an opening at the wall of a breakthrough, conductive paste flowed in there, conductive paste sank in and the technical problem that the part 16 occurred occurred. And although what impregnated nonwoven fabrics, such as an aramid fiber and glass fiber, with the epoxy resin is put in practical use as mentioned above as a porous insulation base, Since that kind of insulating base material was porosity, this conductive paste sank in and generating of the part had become a big solution technical problem which is very hard to avoid.

[0010]Since a coefficient of thermal expansion had a difference, the conductors 1 and the insulating base materials 2 of conductive paste of a beer hall are heating processes, such as reflow soldering, and had the technical problem that electric connection fell and the reliability as the circuit board deteriorated by repetition of elasticity by heating cooling.

[0011]This invention is a sheet in which such an insulating substrate consists of a resin impregnation fibrous sheet. The conventional technical problem relevant to being the porosity in which a composite sheet contains a remains stoma in front of heat pressing is solved. The connection reliability according the state of the inner wall of through hole for the beer halls after shaping to a good fake bundle and a beer hall is improved, and a printed wired board which does not cause the dielectric breakdown by a beer hall faulty connection and migration, etc., and a manufacturing method for the same are provided.

[0012]

[Means for Solving the Problem] This invention about a printed wired board provided with a beer hall for electrode connection the above-mentioned beer hall, It is characterized by breakthrough for beer halls formed in a substrate for an insulation which consists of a resin impregnation fibrous sheet, a resin layer formed in an internal surface of this breakthrough, connected conductors with which it was filled up inside this breakthrough via this resin layer, and \*\*\*\*\*.

[0013] Such printed wired board \*\*\*\* a beerhole conductor, a smooth hole which blocks these beforehand by a resin layer even if a wall of a breakthrough has a coarse dent and fine pores, and a resin layer forms since a resin layer is infixed in a breakthrough and restoration formation is carried out -- since an inner surface is filled up with a conductor, a dielectric breakdown by a beer hall faulty connection and migration, etc. are prevented effectively.

[0014] Although a manufacturing method of a printed wired board of this invention is a method of manufacturing a printed wired board which equipped with a beer hall for electrode connection a substrate for an insulation which consists of a resin impregnation fibrous sheet, The above-mentioned beer hall is formed by forming a breakthrough for beer halls in this substrate for an insulation, and forming connected conductors in the breakthrough inside, while covering formation of the resin layer was carried out and this resin layer had been placed between this breakthrough inner surface after that.

[0015] Even if a method of this invention forms a breakthrough for beer halls in a substrate for an insulation and there are a dent and fine pores of a breakthrough coarse to a wall in that case, next -- precise, if restoration formation of the connected conductors is carried out, since a resin layer to form can block these beforehand and it can form in smooth inner skin of a resin layer -- connection -- a positive beer hall can be formed.

[0016]

[Embodiment of the Invention] It comes to infix the resin layer 30 at one between the breakthrough 3 and the connected conductors 1 which were formed in the substrate 2 for an insulation, and the beer hall 10 provided in the printed wired board of this invention is \*\*, as shown in drawing 1. The 1st gestalt of this invention is a process in which the breakthrough 3 is formed in the substrate for an insulation, and uses the heating and dissolving ingredient of resin of content for a resin impregnation fibrous sheet at the resin layer 30. That is, after the resinous principle contained in a resin impregnation fibrous sheet carries out heating and dissolving, let the cured body of the resin membrane which remains in the breakthrough inside be a resin layer.

[0017] The 2nd gestalt embeds resin liquid at the breakthrough 3 of a resin impregnation fibrous sheet [ in / for the above-mentioned resin layer / the breakthrough morphosis ], and forms it in the resin curing object as the remainder which punches a breakthrough.

[0018] Let the 3rd gestalt be a dry hardening layer of the resin liquid which applied the above-mentioned resin layer 30 to the breakthrough for the beer halls of the printed wired board in the breakthrough morphosis.

[0019] It is made by a beer hall's heating and forming a breakthrough in this substrate for an insulation in the manufacturing method of the printed wired board of this invention, and the 4th gestalt's forming the above-mentioned resin layer in a breakthrough inner surface by the heating and dissolving ingredient of the substrate for an insulation in the case of this breakthrough formation, and forming connected conductors in the resin layer inside after that. Since a laser beam exposure can punch a byway, it is used for heating formation of the resin layer of a breakthrough and after that. Especially laser radiation has preferred CO<sub>2</sub> gas laser exposure.

[0020] After forming a breakthrough in the substrate for an insulation, the 5th gestalt fills up this breakthrough with thermosetting resin separately, it punches the breakthrough of a byway anew and the manufacturing method of the printed wired board of this invention uses it as the resin curing object with the above-mentioned resin layer. It is the same as the above to form connected conductors in the resin layer inside after that.

[0021] After formation of the above-mentioned breakthrough, resin liquid is made to adhere to this breakthrough inner surface, post-dry hardening is carried out, and the 6th gestalt forms a resin layer in breakthrough inner skin, and carries out restoration formation of the connected conductors after that at a breakthrough. In this method, the thin resin liquid which thinned resin liquid with the volatilization solvent is used in more detail, thin resin liquid is applied to the substrate for an insulation after breakthrough formation, subsequently dry hardening is carried out, resin membrane is formed in breakthrough inner skin, and this is used for a resin layer.

[0022] Although a resin impregnation fibrous sheet is used for the insulating substrate 2 used for this invention, it is suitably chosen as the textiles of a fibrous sheet out of a material excellent in the electrical property and the mechanical strength, and the thermoplastics which excelled [ impregnating resin ] in the electrical property and the mechanical strength. Preferably, the textile fabrics and the nonwoven fabric of glass fiber or an aramid fiber are used, an epoxy resin or bismaleimide triazine resin is used as impregnating resin as textiles, and the composite material with which textile fabrics and a nonwoven fabric were impregnated in resin liquid and which was fabricated to the sheet shaped is used. In this, a glass fiber epoxy resin composite, a glass fiber bismaleimide triazine resin composite, an aramid fiber epoxy resin composite, and an aramid fiber bismaleimide triazine resin composite can be illustrated.

[0023] The resin layer 30 can use the same epoxy resin as a substrate material, and bismaleimide triazine resin, although thermosetting resin excellent in an electrical property and mechanical properties is used preferably. To the above-mentioned resin layer, it is preferred that the filler of electric insulation contains. As such a filler, oxidation aluminum (aluminum<sub>2</sub>O<sub>3</sub>). Inorganic materials, such as magnesium oxide (MgO) and SiO<sub>2</sub>, are used preferably, and since a filler is excellent in the mechanical strength at the same time it works to prevention of migration etc. as an electric insulator, it works also as a reinforcing member of a paste part. Since thermal conductivity is also high, especially the above-mentioned filler works also as thermal beer which misses promptly the quantity of heat generated with a semiconductor etc.

[0024] The connected conductors 1 are filled up with a paste by the usual method in the breakthrough which the cured body of the mixed paste of heat-hardened type resin liquid and the powder for conductors (for example, metal powder, such as copper and silver) was used, for this reason formed the resin layer in inner skin, are made to harden it by heating, and let them be conductive connected conductors.

[0025] The preparation method of the printed wired board illustrated below first is explained. The hole which carried out exposure heating of the laser beam in the corresponding part of the beer hall 10 of an insulating base material, using CO<sub>2</sub> gas laser irradiation equipment as one example of the processing method of the breakthrough 3 to the insulation base 2, and was penetrated to the thickness direction about a 4th embodiment is formed. In this case, it is controlled so that the resin layer 30 is formed in the inner circumference of the breakthrough 3. Impregnating resin of a corresponding part once fuses the resin layer 30 of this inner-wall-of-through-hole part with the heat generated in the insulation base by laser radiation, it adheres to the wall part after processing, and is formed as it is after coagulation.

[0026] In order to provide this melting resin layer, the processing method with moderate suitable heat to generate and processing-conditions setting out suitable again are needed for melting of resin at the time of a heating process. replacing with CO<sub>2</sub> laser radiation processing machine, and setting up number of rotations, a feed rate, etc. appropriately in NC drill machine -- a hole -- melting resin liquid is formed with penetration -- and a hole -- it is controlled to remain to inner circumference.

[0027] However, CO<sub>2</sub> gas laser processing method with which the processing methods or the suitable conditioning by high energy laser, such as excimer laser, are not made, In a drilling method, resin does not fuse, particle evapotranspiration cannot be carried out and a desired resin layer cannot sometimes be formed [ sublimation, a pyrolysis or ] in an inner-wall-of-through-hole part. As for especially an impregnating resin fiber sheet, it is common that are porosity or, as for textiles and resin, thermal mechanical properties are different, and, also thermally and mechanically, not by homogeneous material but by cutting and laser heating in the case of breakthrough processing. that the portion of impregnating resin of the impregnating resin fiber sheet of breakthrough inner circumference and the portion of textiles become unreserved at an inner-wall-of-through-hole part \*\*\*\* -- unevenness -- it will pluck and galling etc. will occur.

[0028] So, when formation of the resin layer by such melting resin liquid is based on the difficult processing method like the 5th gestalt. Even if the breakthrough of an oversized diameter is once formed from a desired diameter by this processing method, it plucks to breakthrough inner skin

temporarily and galling etc. occur. A resin layer can be formed in an inner wall of through hole by being filled up with a thermosetting resin solution, embedding in a wall separately, and opening the breakthrough of a desired diameter in a breakthrough again after the hardening. Thus, the resin which carried out restoration hardening is comparatively homogeneous, and can form an internal surface smoothly. For this reason, resin with a sufficient hole moldability is used for resin for these resin layers by processing and drilling by laser.

[0029]In addition to this, processing methods other than a laser beam machining method can be applied similarly, and such a method of carrying out breakthrough processing twice becomes more possible [ a drilling method or forming reliable beer ] than providing a resin layer in a wall at once if it is processed on a suitable material and conditions.

[0030]The method of this invention can also provide a resin layer like the 6th gestalt by applying resin to an inner wall of through hole after shaping of a breakthrough. In this case, although the method of applying resin has various methods, For example, a resin solution can be sprayed and applied with the method of dissolving with a solvent etc. the insulating base material which fabricated the breakthrough, and immersing into resin liquid, a spray coater, etc., dry hardening can be carried out after that, and a resin layer can be formed in an inner wall of through hole by the method of coat-izing, etc.

[0031]It is good for concentration [ \*\*\*\* ] thru/or low viscosity to control a resin solution so that an inner wall of through hole may not be got blocked in the case of this spreading, and blowing away the resin got blocked with compressed air etc. in the breakthrough between uncured states to some extent also has an effective resin solution immediately after spreading.

[0032](Example 1) The insulation base of the composite sheet which the aramid nonwoven fabric was impregnated with the epoxy resin as an insulating base material, and was made (100 micrometers in thickness.) Using 500x600 mm, relevant conditions were able to be set up so that a resin layer could be formed in it at an inner-wall-of-through-hole part (perforation condition; 100 – 300 hole / sec), a breakthrough 150 micrometers in diameter was able to be fabricated with CO<sub>2</sub> laser beam machine, and the resin layer was able to be formed simultaneously.

Subsequently, the electrical conducting material was filled up with the conductive paste which kneaded copper impalpable powder and a resin main component epoxy resin, heat pressure molding was carried out with vacuum heat pressing on both sides of both sides after forming a beer hall by copper foil, the pattern for inner layers was formed in copper foil by etching, and the printed wired board for inner layers was obtained.

[0033]The insulating base material which opened a breakthrough 150 micrometers in diameter and was filled up with the paste with conductivity like the above-mentioned printed wired board for inner layers as a patchboard for outer layers is formed, Interview lamination of the printed wired board for these outer layers was carried out at the both sides of the above-mentioned substrate for inner layers, it faced across the outside surface by copper foil, vacuum heat pressing performed heat pressure molding, the pattern for outer layers was formed by etching, and the multilayer printed circuit board for an examination of three layers was obtained.

[0034](Example 2) The aramid epoxy composite which is the porous base material which the aramid nonwoven fabric was impregnated with the epoxy resin, and was made is used as an insulating base material, A breakthrough 150 micrometers in diameter is opened in it with NC drill breakthrough processing machine, it is filled up with conductive paste, heat pressure molding is carried out with vacuum heat pressing on both sides of both sides after forming a beer hall by copper foil, the pattern for inner layers is formed by etching, and the patchboard for inner layers is obtained.

[0035]Similarly, open a breakthrough 150 micrometers in diameter, fill up a paste with conductivity with NC drill breakthrough processing machine, and two insulating base materials for outer layers are formed, The both sides of the above-mentioned patchboard for inner layers were interviewed, the patchboard for these outer layers was laminated, it was crowded with copper foil across the surface, vacuum heat pressing performed heat pressure molding, the pattern for outer layers was formed by etching, and the substrate for an examination was obtained.

[0036](Example 3) The breakthrough was filled up with epoxy resin paste after opening a breakthrough 200 micrometers in diameter in it with an excimer-laser-processing machine using the porous base material which the aramid nonwoven fabric was impregnated with the epoxy resin as an insulating base material, and was made. Restoration of an epoxy resin is performed by stuffing the epoxy resin paste of the letter of half-kneading into a breakthrough by a squeegee etc., and the breakthrough of the diameter of the request with a resin layer is obtained to an inner wall of through hole by punching a breakthrough 150 micrometers in diameter by excimer laser after that again at the same position. Next, it is filled up with conductive paste, heat pressure molding is carried out with vacuum heat pressing on both sides of both sides after forming a beer hall by copper foil, the pattern for inner layers is formed by etching, and the patchboard for inner layers is obtained.

[0037]A breakthrough is filled up with epoxy resin paste like the above-mentioned patchboard for inner layers as an object for outer layers. After providing a breakthrough with a resin layer in a breakthrough wall by punching a breakthrough 150 micrometers in diameter by excimer laser again at the same position, the patchboard for outer layers which filled up the breakthrough with conductive paste was formed. Two patchboards for outer layers were arranged on the both sides of the patchboard for inner layers, and it inserted, and was crowded with copper foil, vacuum heat pressing performed heat pressure molding, the pattern for outer layers was formed by etching, and the substrate for an examination was obtained.

[0038](Example 4) The aramid epoxy composite which is the porous base material which the aramid nonwoven fabric was impregnated with the epoxy resin, and was made is used as an insulating base material, After opening a breakthrough 180 micrometers in diameter in it with an excimer-laser-processing machine etc., applying a resin solution to an inner-wall-of-through-hole part, forming a resin layer and making a breakthrough into a desired diameter, It is filled up with conductive paste, heat pressure molding is carried out with vacuum heat pressing on both sides of both sides after forming beer by copper foil, the pattern for inner layers is formed by etching, and the patchboard for inner layers is obtained.

[0039]Similarly, in order to obtain the patchboard for outer layers, a breakthrough 180 micrometers in diameter is opened with an excimer-laser-processing machine etc., After forming a resin layer in an inner-wall-of-through-hole part and making a breakthrough into a desired diameter by applying a resin solution, The insulating base material which filled up the breakthrough with conductive paste was formed, it allotted both sides, and it inserted, and was crowded with copper foil, vacuum heat pressing performed heat pressure molding, the pattern for outer layers was formed by etching, and the multilayer interconnection board for an examination was obtained.

[0040](Example 5) The thing containing a filler was used as resin embedded in order to form a resin layer in an inner-wall-of-through-hole part, and also the substrate for an examination was created completely like Example 3. As a filler material, the insulating material of an inorganic substance system was mixed and used for the resin material. The coefficient of thermal expansion is made into the almost same value as conductive paste by selecting a filler material appropriately and adjusting content.

[0041](Example 6) The thing containing a filler was used as resin embedded in order to form a resin layer in an inner-wall-of-through-hole part, and also the substrate for evaluation was created completely like Example 4. As a filler material, the insulating material of an inorganic substance system was mixed and used for the resin material. The coefficient of thermal expansion is made into the almost same value as conductive paste by selecting a filler material appropriately and adjusting content.

[0042](Comparative example) Open a breakthrough 150 micrometers in diameter with the porous base material excimer-laser-processing machine which the aramid nonwoven fabric was impregnated with the epoxy resin, and was made as an object for comparative examples, and it is filled up with conductive paste, and After forming beer, On both sides of both sides, heat pressure molding was carried out with vacuum heat pressing by copper foil, the pattern for inner layers was formed by etching, the board for inner layers was obtained, and the board for outer layers was obtained still more nearly similarly.

[0043]Between the board for inner layers, and the board for outer layers, the press performed heat pressure molding, the pattern for outer layers was formed by etching, and the testing board of the comparative example was obtained.

[0044]The reliability of a beer hall and electric connection and the migration resistance nature (insulation) between beer were evaluated using the substrate for an examination created in this example and a comparative example. The valuation method of the electric connection reliability of the beer created by the printed wired board of this invention is performed as follows.

[0045](1) Beer connection performs the valuation method of the connection resistance of beer hall connection resistance beer by the measure resistance which connected 500 chain wiring in series. It asks for a totaled part of the connection resistance and wiring resistance for 500 beer by 4 terminal measuring methods, and the variation of the beer resistance before and behind an examination is calculated. The heat cycle test and the solder dip (solder immersion) examination, and the oil dip (oil immersion) examination were done as a reliability trial.

[0046]A heat cycle test is neglected at -55 \*\* in the gaseous phase for 30 minutes, and when neglect is repeated for 30 minutes and it carries out 1000 times at back+125 \*\*, the variation of beer connection resistance compares it. A solder dip examination measures and measures the variation of beer connection resistance similarly [ after soaking in the solder tub dissolved in 230 \*\* for 10 seconds ].

[0047]An oil dip examination is a heat cycle test in the liquid phase by oil. It soaks for 10 seconds into the oil which heated the testing board to 260 \*\* of elevated temperatures, and it holds for 10 seconds at a room temperature, and soaks for 10 seconds into 20 more \*\* oil. After evaluation repeats this temperature cycle 200 times, it is performed. Then, it checks that an elevated-temperature and low temperature side measures resistance when [ each ] having soaked, and 200 times of intermission lines cannot be found, and the amount of changes in resistance of 200 times after is measured and measured.

[0048](2) Provide chain wiring of 500 beer connected to the migration resistance sex-test electrical-and-electric-equipment target, set the interval immediately fixed into a next door, and provide chain wiring of 500 beer electrically connected. Each chain wiring is not connected. The resistance between each chain wiring after giving the potential difference of +35V to each of these wiring chain and neglecting it in 60 \*\*95% of wet heat for 1000 hours was compared. The evaluation result of such electric connection reliability and migration resistance nature is shown in Table 1.

[0049]

[Table 1]

試験内容	抵抗値の変化量 Ω			抵抗値 ×10 <sup>12</sup> Ω
	温度サイクル	半田浸	油漬	
実施例 1	0.40	0.52	0.46	3.7
実施例 2	0.38	0.51	0.54	3.6
実施例 3	0.39	0.50	0.51	4.0
実施例 4	0.41	0.49	0.47	4.1
実施例 5	0.30	0.31	0.34	8.1
実施例 6	0.28	0.35	0.37	7.4
比較例 1	1.85	2.87	3.08	1.3

[0050]As shown in Table 1, the printed wired board of this example understands a thing with the small amount of connection resistance value changes compared with the printed wired board of a comparative example. It turns out that migration resistance nature is also good. What mixed the filler especially to the resin layer of the inner wall of through hole is understood that electric connection reliability improves, an insulation resistance value is high and migration resistance nature is improving. The connection reliability according the state of a beer hall inner wall of through hole to a fitness smooth fake bundle and a beer hall is improved, and it can avoid causing the dielectric breakdown by a beer hall faulty connection and migration, etc. by forming a resin layer in the wall of a breakthrough in the printed wired board of this invention.

[0051]

[Effect of the Invention]As mentioned above, even when a porous base material is used by forming a resin layer in the wall of a breakthrough, the printed wired board and manufacturing method of this invention, The inside of a breakthrough can be certainly filled up with a good fake bundle and conductive paste for the state of a beer hall inner wall of through hole, the connection reliability by a beer hall is improved, it can avoid causing the dielectric breakdown by a beer hall faulty connection and migration, etc., and quality can be raised substantially.

[Translation done.]

**\* NOTICES \***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**TECHNICAL FIELD**

[Field of the Invention]This invention relates to a printed wired board which has an inner beer hall used since electronic parts, such as semiconductor devices, such as CPU and a memory, other resistors, and a capacitor, a chip, etc. are carried, and a manufacturing method for the same.

---

[Translation done.]



\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

PRIOR ART

---

[Description of the Prior Art]Recently, as for the printed-circuit board, the degree of location of chips, such as a semiconductor device, a resistor, and a capacitor, etc. has become very high for much more miniaturization of a portable electronic device, and slimming down. Therefore, densification also of the printed wired board for mounting this must be carried out.

The multilayer printed wiring board was invented in order to cope with such the actual condition. The multilayer printed wiring board forms the conductor circuit in two or more substrates (inner layer circuit board) which constitute this beforehand, and enables mounting of high integration electronic parts by joining these substrates of each other.

[0003]In such a multilayer printed wiring board, it is necessary for the conductor circuit between each class to perform electrical continuity. Usually, in order to make it flow electrically [ inter-electrode / of each class ], the through hole is provided, current flows through this hole, and electric connection is made.

[0004]As how to provide this through hole, various methods, such as a method by plating and a method by conductive paste, are proposed and enforced. As a general manufacturing method about an all directions method, NC drill machine, a laser breakthrough processing machine, etc. perform breakthrough processing first, and the flow between layers is aimed at by plating in a breakthrough after that or putting in conductive paste etc.

[0005]For example, in the multilayer substrate shown in JP,7-115279,A, and its manufacturing method, the manufacturing method of this kind of printed wired board is indicated concretely. This method to the process of processing the breakthrough for beer halls into an insulation material layer, and this breakthrough A conductive particle. The process of being filled up with the conductive paste which consists of liquefied resin and a granular material hardening agent. It faces across both sides of the insulation material layer which has the beer in which it filled up with conductive paste by copper foil, Process the process bonded by thermo-compression and said copper foil, and the circuit pattern for inner layers is formed, A multilayer printed wired board is formed by a series of processes of the process considered as double-sided board composition, and the process which bond further the insulation material layer which has said beer hall, and said copper foil by thermo-compression by turns to the both sides or one side of this double-sided board, and processes said copper foil, forms a circuit pattern, and is made into multilayered constitution.

[0006]To a printed wired board, with electric nature these days A mechanical strength, The composite with which the synthetic resin resin board, and the textile fabrics and the nonwoven fabric of especially tough textiles, such as an aramid fiber, which carried out fiber reinforcement were impregnated in the epoxy resin etc. and which was especially made into the sheet shaped from the demand of the intensity in an elevated temperature was used, and it has contributed to the heat-resistant improvement in a wiring board. as such a multilayer wiring board -- drawing 2 -- two or more substrates (inner layer circuit board) 2 -- the example of the multilayer printed wiring board which established the beer hall 10 in ... by the conductor 10 by conductive paste, and connected between the electrodes 4 and 4 to it is shown.

---

[Translation done.]

**\* NOTICES \***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**EFFECT OF THE INVENTION**

---

[Effect of the Invention] As mentioned above, even when a porous base material is used by forming a resin layer in the wall of a breakthrough, the printed wired board and manufacturing method of this invention, The inside of a breakthrough can be certainly filled up with a good fake bundle and conductive paste for the state of a beer hall inner wall of through hole, the connection reliability by a beer hall is improved, it can avoid causing the dielectric breakdown by a beer hall faulty connection and migration, etc., and quality can be raised substantially.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

TECHNICAL PROBLEM

---

[Problem(s) to be Solved by the Invention]However, in relation to that an insulating substrate is a sheet of the composite of the textile fabrics and the nonwoven fabric of textiles, and impregnating resin, and being the porosity in which a composite sheet contains a remains stoma in front of heat pressing further, when forming a breakthrough in an insulating substrate, it was easy to produce a defect in the wall. When processing a breakthrough into the insulating base material which comprises the above-mentioned composite, the wall of the breakthrough of the beer hall of a printed wired board became it coarse that a processing method was unsuitable, it plucked and there was a problem that galling etc. occurred. After the defect of these breakthroughs fills up a breakthrough with conductive paste, when heat pressing is performed, occasionally, The conductive paste which became fluid flows into a coarse inner wall of through hole, Carried out the contact short circuit to the conductor of the adjoining beer hall, or it became a cause of migration, or the conductive paste which should be embedded flowed out of the breakthrough, and decreased, and the technical problem that electrical link with a as sufficient beerhole conductor as the electrode between layers could not be taken was left behind after hardening.

[0008]For example, after forming the breakthrough 3 in the insulating substrate 2 by excimer laser, fill up the hole 3 with the conductive paste 1, subsequently put between drawing 3 by the copper foil 4, and the state at the time of carrying out heat pressing is notionally shown in it, but. In a processing method of high energy like excimer laser. the wall of a breakthrough processed in order for there to be nothing and to carry out decomposition evaporation in an instant also while the impregnating resin which constitutes the insulating substrate 2 of a composite fuses — skin — since it is rude, it can pluck, galling etc. occur in a wall part and a conductive paste flows into the portion, conductive paste will permeate and the lump part 16 will occur. Therefore, the technical problem that the loose connection part 17 is not only formed, but sufficiency of the conductive paste with which it filled up in the breakthrough was insufficient, and the migration resistance nature between beer halls got worse remarkably occurred.

[0009]Since the insulating base material was porosity as prepreg, since fine pores became unreserved as an opening at the wall of a breakthrough, conductive paste flowed in there, conductive paste sank in and the technical problem that the part 16 occurred occurred. And although what impregnated nonwoven fabrics, such as an aramid fiber and glass fiber, with the epoxy resin is put in practical use as mentioned above as a porous insulation base, Since that kind of insulating base material was porosity, this conductive paste sank in and generating of the part had become a big solution technical problem which is very hard to avoid.

[0010]Since a coefficient of thermal expansion had a difference, the conductors 1 and the insulating base materials 2 of conductive paste of a beer hall are heating processes, such as reflow soldering, and had the technical problem that electric connection fell and the reliability as the circuit board deteriorated by repetition of elasticity by heating cooling.

[0011]This invention is a sheet in which such an insulating substrate consists of a resin impregnation fibrous sheet, The conventional technical problem relevant to being the porosity in which a composite sheet contains a remains stoma in front of heat pressing is solved, The connection reliability according the state of the inner wall of through hole for the beer halls after shaping to a good fake bundle and a beer hall is improved, and a printed wired board which does not cause the dielectric breakdown by a beer hall faulty connection and migration, etc., and a manufacturing method for the same are provided.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

MEANS

---

[Means for Solving the Problem]This invention about a printed wired board provided with a beer hall for electrode connection the above-mentioned beer hall. It is characterized by breakthrough for beer halls formed in a substrate for an insulation which consists of a resin impregnation fibrous sheet, a resin layer formed in an internal surface of this breakthrough, connected conductors with which it was filled up inside this breakthrough via this resin layer, and \*\*\*\*\*.

[0013]Such printed wired board \*\*\*\* a beerhole conductor, a smooth hole which blocks these beforehand by a resin layer even if a wall of a breakthrough has a coarse dent and fine pores, and a resin layer forms since a resin layer is infixed in a breakthrough and restoration formation is carried out — since an inner surface is filled up with a conductor, a dielectric breakdown by a beer hall faulty connection and migration, etc. are prevented effectively.

[0014]Although a manufacturing method of a printed wired board of this invention is a method of manufacturing a printed wired board which equipped with a beer hall for electrode connection a substrate for an insulation which consists of a resin impregnation fibrous sheet, The above-mentioned beer hall is formed by forming a breakthrough for beer halls in this substrate for an insulation, and forming connected conductors in the breakthrough inside, while covering formation of the resin layer was carried out and this resin layer had been placed between this breakthrough inner surface after that.

[0015]Even if a method of this invention forms a breakthrough for beer halls in a substrate for an insulation and there are a dent and fine pores of a breakthrough coarse to a wall in that case, next — precise, if restoration formation of the connected conductors is carried out, since a resin layer to form can block these beforehand and it can form in smooth inner skin of a resin layer — connection — a positive beer hall can be formed.

[0016]

[Embodiment of the Invention]It comes to infix the resin layer 30 at one between the breakthrough 3 and the connected conductors 1 which were formed in the substrate 2 for an insulation, and the beer hall 10 provided in the printed wired board of this invention is \*\*, as shown in drawing 1. The 1st gestalt of this invention is a process in which the breakthrough 3 is formed in the substrate for an insulation, and uses the heating and dissolving ingredient of resin of content for a resin impregnation fibrous sheet at the resin layer 30. That is, after the resinous principle contained in a resin impregnation fibrous sheet carries out heating and dissolving, let the cured body of the resin membrane which remains in the breakthrough inside be a resin layer.

[0017]The 2nd gestalt embeds resin liquid at the breakthrough 3 of a resin impregnation fibrous sheet [ in / for the above-mentioned resin layer / the breakthrough morphosis ], and forms it in the resin curing object as the remainder which punches a breakthrough.

[0018]Let the 3rd gestalt be a dry hardening layer of the resin liquid which applied the above-mentioned resin layer 30 to the breakthrough for the beer halls of the printed wired board in the breakthrough morphosis.

[0019]It is made by a beer hall's heating and forming a breakthrough in this substrate for an insulation in the manufacturing method of the printed wired board of this invention, and the 4th gestalt's forming the above-mentioned resin layer in a breakthrough inner surface by the heating and dissolving ingredient of the substrate for an insulation in the case of this breakthrough formation, and forming connected conductors in the resin layer inside after that. Since a laser beam exposure can punch a byway, it is used for heating formation of the resin layer of a breakthrough and after that. Especially laser radiation has preferred CO<sub>2</sub> gas laser exposure.

[0020]After forming a breakthrough in the substrate for an insulation, the 5th gestalt fills up this breakthrough with thermosetting resin separately, it punches the breakthrough of a byway anew and the manufacturing method of the printed wired board of this invention uses it as the resin curing object with the above-mentioned resin layer. It is the same as the above to form connected conductors in the resin layer inside after that.

[0021]After formation of the above-mentioned breakthrough, resin liquid is made to adhere to this breakthrough inner surface, post-dry hardening is carried out, and the 6th gestalt forms a resin layer in breakthrough inner skin, and carries out restoration formation of the connected conductors after that at a breakthrough. In this method, the thin resin liquid which thinned resin liquid with the volatilization solvent is used in more detail, thin resin liquid is applied to the substrate for an insulation after breakthrough formation, subsequently dry hardening is carried out, resin membrane is formed in breakthrough inner skin, and this is used for a resin layer.

[0022]Although a resin impregnation fibrous sheet is used for the insulating substrate 2 used for this invention, it is suitably chosen as the textiles of a fibrous sheet out of a material excellent in the electrical property and the mechanical strength, and the thermoplastics which excelled [ impregnating resin ] in the electrical property and the mechanical strength. Preferably, the textile fabrics and the nonwoven fabric of glass fiber or an aramid fiber are used, an epoxy resin or bismaleimide triazine resin is used as impregnating resin as textiles, and the composite material with which textile fabrics and a nonwoven fabric were impregnated in resin liquid and which was fabricated to the sheet shaped is used. In this, a glass fiber epoxy resin composite, a glass fiber bismaleimide triazine resin composite, an aramid fiber epoxy resin composite, and an aramid fiber bismaleimide triazine resin composite can be illustrated.

[0023]The resin layer 30 can use the same epoxy resin as a substrate material, and bismaleimide triazine resin, although thermosetting resin excellent in an electrical property and mechanical properties is used preferably. To the above-mentioned resin layer, it is preferred that the filler of electric insulation contains. As such a filler, oxidation aluminum (aluminum<sub>2</sub>O<sub>3</sub>), Inorganic materials, such as magnesium oxide (MgO) and SiO<sub>2</sub>, are used preferably, and since a filler is excellent in the mechanical strength at the same time it works to prevention of migration etc. as an electric insulator, it works also as a reinforcing member of a paste part. Since thermal conductivity is also high, especially the above-mentioned filler works also as thermal beer which misses promptly the quantity of heat generated with a semiconductor etc.

[0024]The connected conductors 1 are filled up with a paste by the usual method in the breakthrough which the cured body of the mixed paste of heat-hardened type resin liquid and the powder for conductors (for example, metal powder, such as copper and silver) was used, for this reason formed the resin layer in inner skin, are made to harden it by heating, and let them be conductive connected conductors.

[0025]The preparation method of the printed wired board illustrated below first is explained. The hole which carried out exposure heating of the laser beam in the corresponding part of the beer hall 10 of an insulating base material, using CO<sub>2</sub> gas laser irradiation equipment as one example of the processing method of the breakthrough 3 to the insulation base 2, and was penetrated to the thickness direction about a 4th embodiment is formed. In this case, it is controlled so that the resin layer 30 is formed in the inner circumference of the breakthrough 3. Impregnating resin of a corresponding part once fuses the resin layer 30 of this inner-wall-of-through-hole part with the heat generated in the insulation base by laser radiation, it adheres to the wall part after processing, and is formed as it is after coagulation.

[0026]In order to provide this melting resin layer, the processing method with moderate suitable heat to generate and processing-conditions setting out suitable again are needed for melting of resin at the time of a heating process. replacing with CO<sub>2</sub> laser radiation processing machine,

and setting up number of rotations, a feed rate, etc. appropriately in NC drill machine -- a hole -- melting resin liquid is formed with penetration -- and a hole -- it is controlled to remain to inner circumference.

[0027]However, CO<sub>2</sub> gas laser processing method with which the processing methods or the suitable conditioning by high energy laser, such as excimer laser, are not made, In a drilling method, resin does not fuse, particle evapotranspiration cannot be carried out and a desired resin layer cannot sometimes be formed [ sublimation, a pyrolysis or ] in an inner-wall-of-through-hole part. As for especially an impregnating resin fiber sheet, it is common that are porosity or, as for textiles and resin, thermal mechanical properties are different, and, also thermally and mechanically, not by homogeneous material but by cutting and laser heating in the case of breakthrough processing. that the portion of impregnating resin of the impregnating resin fiber sheet of breakthrough inner circumference and the portion of textiles become unreserved at an inner-wall-of-through-hole part \*\*\*\* -- unevenness -- it will pluck and galling etc. will occur.

[0028]So, when formation of the resin layer by such melting resin liquid is based on the difficult processing method like the 5th gestalt. Even if the breakthrough of an oversized diameter is once formed from a desired diameter by this processing method, it plucks to breakthrough inner skin temporarily and galling etc. occur, A resin layer can be formed in an inner wall of through hole by being filled up with a thermosetting resin solution, embedding in a wall separately, and opening the breakthrough of a desired diameter in a breakthrough again after the hardening. Thus, the resin which carried out restoration hardening is comparatively homogeneous, and can form an internal surface smoothly. For this reason, resin with a sufficient hole moldability is used for resin for these resin layers by processing and drilling by laser.

[0029]In addition to this, processing methods other than a laser beam machining method can be applied similarly, and such a method of carrying out breakthrough processing twice becomes more possible [ a drilling method or forming reliable beer ] than providing a resin layer in a wall at once if it is processed on a suitable material and conditions.

[0030]The method of this invention can also provide a resin layer like the 6th gestalt by applying resin to an inner wall of through hole after shaping of a breakthrough. In this case, although the method of applying resin has various methods, For example, a resin solution can be sprayed and applied with the method of dissolving with a solvent etc. the insulating base material which fabricated the breakthrough, and immersing into resin liquid, a spray coater, etc., dry hardening can be carried out after that, and a resin layer can be formed in an inner wall of through hole by the method of coat-izing, etc.

[0031]It is good for concentration [ \*\*\*\* ] thru/or low viscosity to control a resin solution so that an inner wall of through hole may not be got blocked in the case of this spreading, and blowing away the resin got blocked with compressed air etc. in the breakthrough between uncured states to some extent also has an effective resin solution immediately after spreading.

[0032](Example 1) The insulation base of the composite sheet which the aramid nonwoven fabric was impregnated with the epoxy resin as an insulating base material, and was made (100 micrometers in thickness.) Using 500x600 mm, relevant conditions were able to be set up so that a resin layer could be formed in it at an inner-wall-of-through-hole part (perforation condition;100 - 300 hole / sec), a breakthrough 150 micrometers in diameter was able to be fabricated with CO<sub>2</sub> laser beam machine, and the resin layer was able to be formed simultaneously.

Subsequently, the electrical conducting material was filled up with the conductive paste which kneaded copper impalpable powder and a resin main component epoxy resin, heat pressure molding was carried out with vacuum heat pressing on both sides of both sides after forming a beer hall by copper foil, the pattern for inner layers was formed in copper foil by etching, and the printed wired board for inner layers was obtained.

[0033]The insulating base material which opened a breakthrough 150 micrometers in diameter and was filled up with the paste with conductivity like the above-mentioned printed wired board for inner layers as a patchboard for outer layers is formed, Interview lamination of the printed wired board for these outer layers was carried out at the both sides of the above-mentioned substrate for inner layers, it faced across the outside surface by copper foil, vacuum heat pressing performed heat pressure molding, the pattern for outer layers was formed by etching, and the multilayer printed circuit board for an examination of three layers was obtained.

[0034](Example 2) The aramid epoxy composite which is the porous base material which the aramid nonwoven fabric was impregnated with the epoxy resin, and was made is used as an insulating base material, A breakthrough 150 micrometers in diameter is opened in it with NC drill breakthrough processing machine, it is filled up with conductive paste, heat pressure molding is carried out with vacuum heat pressing on both sides of both sides after forming a beer hall by copper foil, the pattern for inner layers is formed by etching, and the patchboard for inner layers is obtained.

[0035]Similarly, open a breakthrough 150 micrometers in diameter, fill up a paste with conductivity with NC drill breakthrough processing machine, and two insulating base materials for outer layers are formed, The both sides of the above-mentioned patchboard for inner layers were interviewed, the patchboard for these outer layers was laminated, it was crowded with copper foil across the surface, vacuum heat pressing performed heat pressure molding, the pattern for outer layers was formed by etching, and the substrate for an examination was obtained.

[0036](Example 3) The breakthrough was filled up with epoxy resin paste after opening a breakthrough 200 micrometers in diameter in it with an excimer-laser-processing machine using the porous base material which the aramid nonwoven fabric was impregnated with the epoxy resin as an insulating base material, and was made. Restoration of an epoxy resin is performed by stuffing the epoxy resin paste of the letter of half-kneading into a breakthrough by a squeegee etc., and the breakthrough of the diameter of the request with a resin layer is obtained to an inner wall of through hole by punching a breakthrough 150 micrometers in diameter by excimer laser after that again at the same position. Next, it is filled up with conductive paste, heat pressure molding is carried out with vacuum heat pressing on both sides of both sides after forming a beer hall by copper foil, the pattern for inner layers is formed by etching, and the patchboard for inner layers is obtained.

[0037]A breakthrough is filled up with epoxy resin paste like the above-mentioned patchboard for inner layers as an object for outer layers, After providing a breakthrough with a resin layer in a breakthrough wall by punching a breakthrough 150 micrometers in diameter by excimer laser again at the same position, the patchboard for outer layers which filled up the breakthrough with conductive paste was formed. Two patchboards for outer layers were arranged on the both sides of the patchboard for inner layers, and it inserted, and was crowded with copper foil, vacuum heat pressing performed heat pressure molding, the pattern for outer layers was formed by etching, and the substrate for an examination was obtained.

[0038](Example 4) The aramid epoxy composite which is the porous base material which the aramid nonwoven fabric was impregnated with the epoxy resin, and was made is used as an insulating base material, After opening a breakthrough 180 micrometers in diameter in it with an excimer-laser-processing machine etc., applying a resin solution to an inner-wall-of-through-hole part, forming a resin layer and making a breakthrough into a desired diameter, It is filled up with conductive paste, heat pressure molding is carried out with vacuum heat pressing on both sides of both sides after forming beer by copper foil, the pattern for inner layers is formed by etching, and the patchboard for inner layers is obtained.

[0039]Similarly, in order to obtain the patchboard for outer layers, a breakthrough 180 micrometers in diameter is opened with an excimer-laser-processing machine etc., After forming a resin layer in an inner-wall-of-through-hole part and making a breakthrough into a desired diameter by applying a resin solution, The insulating base material which filled up the breakthrough with conductive paste was formed, it allotted both sides, and it inserted, and was crowded with copper foil, vacuum heat pressing performed heat pressure molding, the pattern for outer layers was formed by etching, and the multilayer interconnection board for an examination was obtained.

[0040](Example 5) The thing containing a filler was used as resin embedded in order to form a resin layer in an inner-wall-of-through-hole part, and also the substrate for an examination was created completely like Example 3. As a filler material, the insulating material of an inorganic substance system was mixed and used for the resin material. The coefficient of thermal expansion is made into the almost same value as conductive paste by selecting a filler material appropriately and adjusting content.

[0041](Example 6) The thing containing a filler was used as resin embedded in order to form a resin layer in an inner-wall-of-through-hole part, and also the substrate for evaluation was created completely like Example 4. As a filler material, the insulating material of an inorganic substance system was mixed and used for the resin material. The coefficient of thermal expansion is made into the almost same value as conductive paste

by selecting a filler material appropriately and adjusting content.

[0042](Comparative example) Open a breakthrough 150 micrometers in diameter with the porous base material excimer-laser-processing machine which the aramid nonwoven fabric was impregnated with the epoxy resin, and was made as an object for comparative examples, and it is filled up with conductive paste, and After forming beer, On both sides of both sides, heat pressure molding was carried out with vacuum heat pressing by copper foil, the pattern for inner layers was formed by etching, the board for inner layers was obtained, and the board for outer layers was obtained still more nearly similarly.

[0043]Between the board for inner layers, and the board for outer layers, the press performed heat pressure molding, the pattern for outer layers was formed by etching, and the testing board of the comparative example was obtained.

[0044]The reliability of a beer hall and electric connection and the migration resistance nature (insulation) between beer were evaluated using the substrate for an examination created in this example and a comparative example. The valuation method of the electric connection reliability of the beer created by the printed wired board of this invention is performed as follows.

[0045](1) Beer connection performs the valuation method of the connection resistance of beer hall connection resistance beer by the measure resistance which connected 500 chain wiring in series. It asks for a totaled part of the connection resistance and wiring resistance for 500 beer by 4 terminal measuring methods, and the variation of the beer resistance before and behind an examination is calculated. The heat cycle test and the solder dip (solder immersion) examination, and the oil dip (oil immersion) examination were done as a reliability trial.

[0046]A heat cycle test is neglected at -55 \*\* in the gaseous phase for 30 minutes, and when neglect is repeated for 30 minutes and it carries out 1000 times at back+125 \*\*, the variation of beer connection resistance compares it. A solder dip examination measures and measures the variation of beer connection resistance similarly [ after soaking in the solder tub dissolved in 230 \*\* for 10 seconds ].

[0047]An oil dip examination is a heat cycle test in the liquid phase by oil. It soaks for 10 seconds into the oil which heated the testing board to 260 \*\* of elevated temperatures, and it holds for 10 seconds at a room temperature, and soaks for 10 seconds into 20 more \*\* oil. After evaluation repeats this temperature cycle 200 times, it is performed. Then, it checks that an elevated-temperature and low temperature side measures resistance when [ each ] having soaked, and 200 times of intermission lines cannot be found, and the amount of changes in resistance of 200 times after is measured and measured.

[0048](2) Provide chain wiring of 500 beer connected to the migration resistance sex-test electrical-and-electric-equipment target, set the interval immediately fixed into a next door, and provide chain wiring of 500 beer electrically connected. Each chain wiring is not connected. The resistance between each chain wiring after giving the potential difference of +35V to each of these wiring chain and neglecting it in 60 \*\*95% of wet heat for 1000 hours was compared. The evaluation result of such electric connection reliability and migration resistance nature is shown in Table 1.

[0049]

[Table 1]

試験内容	抵抗値の変化量 $\Omega$			抵抗値 $\times 10^{13}$ $\Omega$
	温度サイクル	半田浸	油漬	
実施例 1	0.40	0.52	0.46	3.7
実施例 2	0.38	0.51	0.54	3.6
実施例 3	0.39	0.50	0.51	4.0
実施例 4	0.41	0.49	0.47	4.1
実施例 5	0.30	0.31	0.34	8.1
実施例 6	0.28	0.35	0.37	7.4
比較例 1	1.85	2.87	3.08	1.3

[0050]As shown in Table 1, the printed wired board of this example understands a thing with the small amount of connection resistance value changes compared with the printed wired board of a comparative example. It turns out that migration resistance nature is also good. What mixed the filler especially to the resin layer of the inner wall of through hole is understood that electric connection reliability improves, an insulation resistance value is high and migration resistance nature is improving. The connection reliability according the state of a beer hall inner wall of through hole to a fitness smooth fake bundle and a beer hall is improved, and it can avoid causing the dielectric breakdown by a beer hall faulty connection and migration, etc. by forming a resin layer in the wall of a breakthrough in the printed wired board of this invention.

[Translation done.]

# PRINTED WIRING BOARD AND ITS MANUFACTURE

**Publication number:** JP11177199

**Publication date:** 1999-07-02

**Inventor:** NISHIYAMA TOSAKU

**Applicant:** MATSUSHITA ELECTRIC IND CO LTD

**Classification:**

**- international:** *H05K1/11; H05K3/00; H05K3/40; H05K3/46; H05K1/11; H05K3/00; H05K3/40; H05K3/46; (IPC 1-7): H05K1/11; H05K3/00; H05K3/40; H05K3/46*

**- European:**

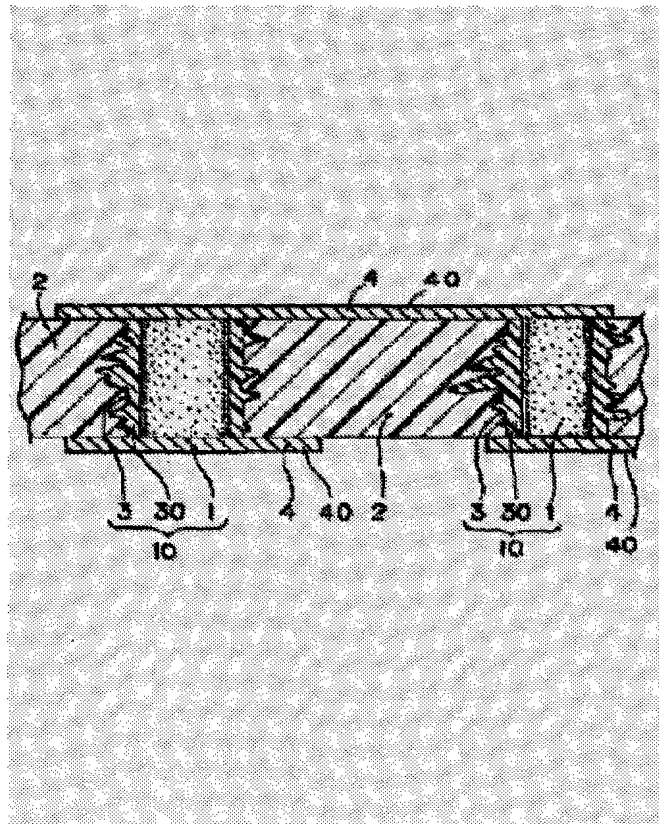
**Application number:** JP19970335823 19971205

**Priority number(s):** JP19970335823 19971205

[Report a data error here](#)

## Abstract of JP11177199

**PROBLEM TO BE SOLVED:** To provide a printed wiring board constituting electronic devices and having improved reliability in electrical connection and a manufacturing method. **SOLUTION:** When a via through hole 10 is made in a printed wiring board, a resin layer is made on the inner wall of the through hole and conductive paste is surely charged into the via hole. This can produce an extremely reliable via hole to prevent a disconnect in the via hole, an electrical breakdown caused by migration or the like even if a porous board is used.



Data supplied from the **esp@cenet** database - Worldwide

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平11-177199

(43) 公開日 平成11年(1999) 7月2日

(51) Int.Cl.<sup>6</sup>

識別記号

F I

H 0 5 K 1/11  
3/00  
3/40  
3/46

H 0 5 K 1/11 N  
3/00 N  
3/40 K  
3/46 T  
N

審査請求 有 請求項の数11 O L (全 7 頁) 最終頁に続く

(21) 出願番号 特願平9-335823

(22) 出願日 平成9年(1997)12月5日

(71) 出願人 000005821

松下電器産業株式会社  
大阪府門真市大字門真1006番地

(72) 発明者 西山 東作

大阪府門真市大字門真1006番地 松下電器  
産業株式会社内

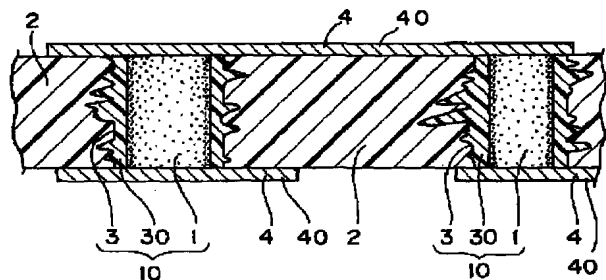
(74) 代理人 弁理士 青山 葆

(54) 【発明の名称】 プリント配線板およびその製造方法

(57) 【要約】

【課題】 本発明は、電子機器等を構成するプリント配線板に関するもので、電気的な接続信頼性を大きく向上できるプリント配線板およびその製造方法を提供することを目的とする。

【解決手段】 プリント配線板のビア貫通孔を貫通孔加工する際に、貫通孔内壁部に樹脂層を設け、導電性ペーストをビア内部に確実に充填することにより多孔質基材を使用した場合でも信頼性の極めて高い良好なビアホールを得ることができビアホール断線不良、マイグレーションによる絶縁破壊不良等を防止できる。





## 【特許請求の範囲】

【請求項1】 電極接続用のビアホールを備えたプリント配線板において、

上記ビアホールが、樹脂含浸繊維シートよりなる絶縁用基材に形成したビアホール用の貫通孔と、該孔内面に被覆形成した樹脂層と、該樹脂層を介して該孔内側に充填硬化された導体と、から成ることを特徴とするプリント配線板。

【請求項2】 上記の樹脂層が、貫通孔形成過程における樹脂含浸繊維シートに含有の樹脂の加熱溶解成分である請求項1のプリント配線板。

【請求項3】 上記樹脂層が、貫通孔形成過程における樹脂含浸繊維シートの貫通孔に樹脂液を埋め込みその樹脂硬化体に貫通孔を穿孔して成る残部であることを特徴とする請求項1のプリント配線板。

【請求項4】 上記樹脂層が、貫通孔形成過程におけるプリント配線板のビアホール用の貫通孔に付着した樹脂液の乾燥硬化膜であることを特徴とするプリント配線板。

【請求項5】 上記樹脂層には、電気絶縁性のフィラーが含有されていることを特徴とする請求項1、3又は4記載のプリント配線板。

【請求項6】 樹脂含浸繊維シートよりなる絶縁用基材に電極接続用のビアホールを備えたプリント配線板の製造方法において、該絶縁用基材にビアホール用の貫通孔を形成し、該貫通孔内面に樹脂層を被覆形成し、その後該樹脂層を介在したまま貫通孔内側に接続導体を形成することにより、上記ビアホールを形成することを特徴とするプリント配線板の製造方法。

【請求項7】 上記貫通孔は該絶縁用基材にレーザ照射加熱して形成し、この貫通孔形成の際に上記樹脂層を絶縁用基材の加熱溶解成分により貫通孔内面に形成することを特徴とする請求項6記載のプリント配線板の製造方法。

【請求項8】 上記貫通孔の形成後に、該貫通孔に樹脂を充填し、その樹脂硬化体に改めて小径の貫通孔を穿孔して上記樹脂層となし、その後樹脂層内側に接続導体を形成することを特徴とする請求項6記載のプリント配線板の製造方法。

【請求項9】 上記貫通孔の形成後に、該貫通孔内面に樹脂液を付着させて後乾燥硬化させて樹脂層を形成し、その後貫通孔に接続導体を充填形成することを特徴とするプリント配線板の製造方法。

【請求項10】 上記貫通孔を絶縁用基材に形成する過程が、CO<sub>2</sub>レーザ加熱加工法を用いることを特徴とする請求項6記載のプリント配線板の製造方法。

【請求項11】 上記樹脂含浸繊維シートが、ガラス繊維又はアラミド繊維と、エポキシ樹脂又はビスマレイミドトリアジン樹脂と、のコンボジットであることを特徴

とする請求項1ないし8何れかに記載のプリント配線板。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、CPU、メモリー等の半導体素子、その他の抵抗器、コンデンサー等の電子部品、チップ部品等を搭載するために用いられるインナービアホールを有するプリント配線板およびその製造方法に関する。

## 【0002】

【従来の技術】最近、携帯用電子機器の一層の小型化と薄型化のために、プリント配線基板は、半導体素子、抵抗器、コンデンサー等のチップ部品等の集積度が非常に高くなっており、そのためこれを実装するためのプリント配線板も高密度化しなければならない。このような実状に対処するために考え出されたのが多層プリント配線板である。多層プリント配線板は、これを構成する複数の基板（内層回路基板）に予め導体回路を形成しておき、これらの基板を互いに接合することによって高集積電子部品の実装を可能にするものである。

【0003】このような多層プリント配線板では、各層間の導体回路に電氣的導通を行うことが必要となる。通常は各層の電極間の電氣的に導通させるためにスルーホールを設けておりこの孔を通して電流が流れ、電氣的な接続が行われるようになっている。

【0004】このスルーホールの設け方としてはめっきによる方法、導電性ペーストによる方法等様々な方法が提案され、実施されている。各方法についての一般的な製造方法としては最初にNCドリルマシン、レーザ貫通孔加工機等により貫通孔加工を行い、その後貫通孔の中にめっきをしたり、導電性ペーストを入れる等により層間の導通を図る。

【0005】例えば特開平7-115279に示される多層基板とその製造方法では具体的にこの種のプリント配線板の製造方法が開示されている。この方法は、絶縁材料層にビアホール用の貫通孔を加工する工程、この貫通孔に導電性粒子、液状樹脂および粉体硬化剤よりなる導電性ペーストを充填する工程、導電性ペーストが充填されたビアを有する絶縁材料層の両面を銅箔で挟み、熱圧着する工程、前記銅箔を加工して内層用回路パターンを形成し、両面板構成とする工程、さらにこの両面板の両側あるいは片側に前記ビアホールを有する絶縁材料層と前記銅箔を交互に熱圧着しかつ前記銅箔を加工して回路パターンを形成し、多層構成とする工程の一連の工程により多層のプリント配線板を形成するものである。

【0006】さらに、最近では、プリント配線板には、電氣的性質とともに、機械的強度、特に高温での強度の要求から、繊維強化した合成樹脂樹脂板、特に、アラミド繊維等の強靱な繊維の織布・不織布にエポキシ樹脂などを含浸してシート状にしたコンボジットが使用され、配

線基板の耐熱性の向上に寄与している。このような多層の配線基板として、図2に、複数の基板（内層回路基板）2・・・に、導電性ペーストによる導体10でビアホール10を設けて電極4、4間を接続した多層プリント配線板の例を示している。

#### 【0007】

【発明が解決しようとする課題】然しながら、絶縁基板が繊維の織布・不織布と含浸樹脂とのコンポジットのシートであること、さらに、熱プレスの前においてはコンポジットシートが残留気孔を含む多孔質であることと関連して、絶縁基板に、貫通孔を形成する際にその内壁に欠陥を生じやすかった。上記コンポジットから成る絶縁基材に貫通孔を加工する際に、加工方法が不適切であると、プリント配線板のビアホールの貫通孔の内壁が粗くなり、むしり、かじり等が発生するという問題があった。これらの貫通孔の欠陥は、貫通孔に導電性ペーストを充填した後に、熱プレスを行うと、ときには、流動的になった導電性ペーストが、粗雑な貫通孔内壁に流れ込んで、隣接するビアホールの導体と接触短絡したり、あるいはマイグレーションの原因となったり、埋め込むべき導電性ペーストが貫通孔から流出して少なくなり、硬化後にはビアホール導体が層間電極と十分な電氣的接続がとれないといった課題が残されていた。

【0008】例えば、図3には、絶縁基板2に貫通孔3をエキシマレーザで形成した後、導電性ペースト1を孔3に充填し、次いで銅箔4で挟み込んで、熱プレスした場合の状態を概念的に示しているが、エキシマレーザのような高エネルギーの加工方法では、コンポジットの絶縁基板2を構成する含浸樹脂が溶融する間もなく瞬時に分解蒸発してしまうために加工された貫通孔の内壁が肌荒れ、むしれ、かじり等が内壁部に発生しその部分に導電性のペーストが流れ込むために導電性ペーストの浸み込み部16が発生することになる。そのため、貫通孔内に充填された導電性ペーストの充足が不十分で、接触不良部17が形成されるだけでなくビアホール間の耐マイグレーション性が著しく悪化するという課題があった。

【0009】また絶縁基材は、アブリゲとして多孔質であるので、貫通孔の内壁に細孔が空隙としてむき出しになるためそこに導電性ペーストが流れこみ、導電性ペーストのしみこみ部16が発生するという課題があった。そして、多孔質の絶縁性基材としては、上述のように、アラミド繊維やガラス繊維等の不織布にエポキシ樹脂を含浸させたものが実用化されているが、その種の絶縁基材は多孔質であるので、この導電性ペーストのしみこみ部の発生は、非常に避けがたい大きな解決課題となっていた。

【0010】また、ビアホールの導電性ペーストの導体1と絶縁基材2とは、熱膨張係数に相違があるために、リフロー半田付け等の加熱工程で、加熱冷却による伸縮の繰返しにより、電氣的な接続が低下して回路基板とし

ての信頼性が劣化するという課題があった。

【0011】本発明は、このような絶縁基板が、樹脂含浸繊維シートよりなるシートであること、さらに、熱プレスの前においてはコンポジットシートが残留気孔を含む多孔質であることと関連した従来の課題を解決し、成形後のビアホール用の貫通孔内壁の状態を良好にせしめ、ビアホールによる接続信頼性を高め、ビアホール接続不良、マイグレーションによる絶縁破壊等を起こさないプリント配線板およびその製造方法を提供するものである。

#### 【0012】

【課題を解決するための手段】本発明は、電極接続用のビアホールを備えたプリント配線板について、上記ビアホールは、樹脂含浸繊維シートよりなる絶縁用基材に形成したビアホール用の貫通孔と、該貫通孔の内壁面に形成した樹脂層と、該樹脂層を介して該貫通孔の内側に充填した接続導体と、から成ることを特徴とする。

【0013】このようなプリント配線板においては、ビアホール導体は、貫通孔に樹脂層を介装して充填形成されるので、貫通孔の内壁に粗雑な凹みや細孔があってもこれらを樹脂層により予め封鎖して、樹脂層が形成する平滑な孔内面に導体が充填されるので、ビアホール接続不良、マイグレーションによる絶縁破壊等が有効に防止される。

【0014】本発明のプリント配線板の製造方法は、樹脂含浸繊維シートよりなる絶縁用基材に電極接続用のビアホールを備えたプリント配線板を製造する方法であるが、該絶縁用基材にビアホール用の貫通孔を形成し、該貫通孔内面に樹脂層を被覆形成し、その後に該樹脂層を介在したまま貫通孔内側に接続導体を形成することにより、上記ビアホールを形成することを特徴とするものである。

【0015】本発明の方法は、絶縁用基材にビアホール用の貫通孔を形成し、その際に貫通孔の内壁に粗雑な凹みや細孔があっても、次に形成する樹脂層によりこれらを予め封鎖することができ、樹脂層の滑らかな内周面に形成できるので、接続導体を充填形成させれば、緻密で接続確実なビアホールが形成できる。

#### 【0016】

【発明の実施の形態】本発明のプリント配線板に具備するビアホール10は、図1に示すように、絶縁用基材2に形成された貫通孔3と接続導体1との間に樹脂層30が一体に介装されてなるものである。本発明の第1の形態は、絶縁用基材に貫通孔3を形成する過程で、樹脂含浸繊維シートに含有の樹脂の加熱溶解成分を、樹脂層30に、利用するものである。即ち、樹脂含浸繊維シートに含有される樹脂成分が加熱溶解した後に貫通孔内側に残る樹脂皮膜の硬化体を樹脂層とするものである。

【0017】第2の形態は、上記樹脂層を、貫通孔形成過程における樹脂含浸繊維シートの貫通孔3に樹脂液を

埋め込みその樹脂硬化体に貫通孔を穿孔して成る残部として形成するものである。

【0018】第3の形態は、上記樹脂層30を、貫通孔形成過程におけるプリント配線板のビアホール用の貫通孔に塗布した樹脂液の乾燥硬化膜とするものである。

【0019】第4の形態は、本発明のプリント配線板の製造方法において、ビアホールは、貫通孔を該絶縁用基材に加熱して形成し、この貫通孔形成の際に上記樹脂層を絶縁用基材の加熱溶解成分により貫通孔内面に形成し、その後に樹脂層内側に接続導体を形成することによりなされる。貫通孔とその後の樹脂層の加熱形成には、レーザビーム照射が、小径に穿孔できるので利用される。特にレーザ照射は、CO<sub>2</sub> ガスレーザ照射が好ましい。

【0020】第5の形態は、本発明のプリント配線板の製造方法が、絶縁用基板に貫通孔を形成した後に、該貫通孔に別途、熱硬化性樹脂を充填し、その樹脂硬化体に改めて小径の貫通孔を穿孔して上記樹脂層とするものである。その後に樹脂層内側に接続導体を形成するのは上記と同じである。

【0021】第6の形態は、上記貫通孔の形成後に、該貫通孔内面に樹脂液を付着させて後乾燥硬化させて貫通孔内周面に樹脂層を形成し、その後貫通孔に接続導体を充填形成することを特徴とする。この方法においては、より詳しくは、樹脂液を揮発溶媒で薄めた希薄樹脂液を使用し、貫通孔形成後の絶縁用基板に希薄樹脂液を塗布し、次いで乾燥硬化させて、貫通孔内周面に樹脂皮膜を形成し、これを樹脂層に利用する。

【0022】本発明に使用される絶縁性基板2には、樹脂含浸繊維シートが使用されるが、繊維シートの繊維には電気的特性と機械的強度に優れた材料から及び含浸樹脂も電気的特性と機械的強度に優れた熱可塑性樹脂から適宜選ばれる。好ましくは繊維として、ガラス繊維又はアラミド繊維の織布・不織布を使用し、含浸樹脂としてエポキシ樹脂又はビスマレイミドトリアジン樹脂を使用して、織布・不織布に樹脂液を含浸してシート状に成形した複合材料が使用される。これには、ガラス繊維エポキシ樹脂コンポジット、ガラス繊維ビスマレイミドトリアジン樹脂コンポジット、アラミド繊維エポキシ樹脂コンポジット、アラミド繊維ビスマレイミドトリアジン樹脂コンポジットが例示できる。

【0023】樹脂層30は、電気的特性と機械的性質に優れた熱硬化性樹脂が好ましく使用されるが、基板材料と同様のエポキシ樹脂、ビスマレイミドトリアジン樹脂が使用できる。上記樹脂層には、電気絶縁性のフィラーが含有されているのが好ましい。このようなフィラーとしては酸化アルミ (Al<sub>2</sub>O<sub>3</sub>)、酸化マグネシウム (MgO)、SiO<sub>2</sub> 等の無機材料が好ましく利用され、フィラーは電気絶縁体としてマイグレーションの防止等に働くと同時に機械的強度に優れているのでペースト部の

補強材としても働く。また特に上記のフィラーは熱伝導性も高いので半導体等で発生する熱量を速やかに逃がすサーマルビアとしても働く。

【0024】接続導体1は、熱硬化型樹脂液と導体用粉末 (例えば、銅や銀などの金属粉末) との混合ペーストの硬化体が使用され、このために、内周面に樹脂層を形成した貫通孔内に、通常の方法によりペーストを充填して、加熱することにより硬化させて、導電性の接続導体とされる。

【0025】最初に以下に例示するプリント配線板の作成方法について説明する。第4の実施形態について、絶縁性基板2への貫通孔3の加工方法の一つの例としてCO<sub>2</sub> ガスレーザ照射装置を用いてレーザビームを絶縁基材のビアホール10の対応部位に照射加熱して厚み方向に貫通した孔を形成する。この際に、貫通孔3の内周に樹脂層30が形成されるように制御される。この貫通孔内壁部の樹脂層30は、レーザ照射により絶縁性基材内に発生した熱により対応部位の含浸樹脂が一旦溶融し加工後の内壁部に固着し、凝固後にそのまま形成される。

【0026】この溶融樹脂層を設けるためには加熱加工時に樹脂の溶融に適度な熱が発生するに好適な加工法とまた適切な加工条件設定が必要となる。CO<sub>2</sub> レーザ照射加工機に代えて、NCドリルマシンでは、回転数、送り速度等を適切に設定して、孔貫通とともに、溶融樹脂液が形成され、且つ孔内周に残留するように制御される。

【0027】しかしながらエキシマレーザ等の高エネルギーレーザによる加工方法や適切な条件設定がなされていないCO<sub>2</sub> ガスレーザ加工方法、ドリル加工方法では樹脂が溶融せず昇華、熱分解や微粒蒸散してしまい、貫通孔内壁部に所望の樹脂層を形成することはできないことがある。特に、含浸樹脂繊維質シートは、多孔質であったり、或いは繊維と樹脂とは熱的機械的性質が相違するのが普通であって熱的にも機械的にも均質材料でなく、貫通孔加工の際の切削やレーザ加熱により、貫通孔内周の含浸樹脂繊維質シートの含浸樹脂の部分や繊維の部分が貫通孔内壁部にむき出しになったり、凹凸やむしり、かじり等が発生してしまう。

【0028】そこで、第5の形態のようにこのような溶融樹脂液による樹脂層の形成が困難な加工法による場合には、この加工法で一度所望の直径より大きい直径の貫通孔を形成し、仮に貫通孔内周面にむしり、かじりなどが発生したとしても、貫通孔に別途、熱硬化性樹脂液を充填して内壁内に埋め込み、その硬化後に再度、所望の直径の貫通孔を開けることにより、貫通孔内壁に樹脂層を形成することができる。このように充填硬化した樹脂は比較的均質であり、内壁面を円滑に形成することができる。このため、この樹脂層用の樹脂には、レーザによる加工やドリル加工で孔成形性の良い樹脂が使用される。

【0029】このような2回貫通孔加工する方法は、ドリル加工法やその他、レーザ加工方法以外の加工方法も同様に適用することができ、適切な材料、条件で加工を行えば1回で内壁に樹脂層を設けるよりも信頼性の高いビアを形成することが可能となる。

【0030】本発明の方法は、第6の形態の如く貫通孔の成形後に、貫通孔内壁に樹脂を塗布することにより樹脂層を設けることもできる。この際に樹脂を塗布する方法は様々な方法があるが、例えば貫通孔を成形した絶縁基材を溶剤等で溶解させ樹脂液中に浸漬する方法、またスプレーコーター等で樹脂溶液を吹き付け塗布し、その後乾燥硬化させて、皮膜化する方法等により貫通孔内壁に樹脂層を形成することができる。

【0031】この塗布の際に、貫通孔内壁が詰まらないように樹脂溶液を希釈濃度ないし低い粘度のコントロールするのがよく、また塗布直後の樹脂溶液が未硬化状態の間に圧縮空気等で貫通孔に詰まっている樹脂をある程度吹き飛ばすのも効果的である。

【0032】(実施例1) 絶縁基材としてアラミド不織布にエポキシ樹脂を含浸させて作ったコンポジットシート(厚み100 $\mu$ m、500×600mm)を用い、それに貫通孔内壁部に樹脂層を形成できるように適切な条件を設定して(穴開け条件; 100~300穴/sec)、CO<sub>2</sub>レーザ加工機で直径150 $\mu$ mの貫通孔を成形し、同時に樹脂層を形成することができた。次いで、導電材料に銅微粉末と樹脂主成分エポキシ樹脂とを混練した導電性ペーストを充填しビアホールを形成後、銅箔で両側を挟み真空熱プレスにより加熱加圧成形し、銅箔に内層用パターンをエッチングで形成して内層用プリント配線板を得た。

【0033】外層用配線板として、上記の内層用プリント配線板と同様にして、直径150 $\mu$ mの貫通孔をあけ導電性を有したペーストを充填した絶縁基材を形成し、これら外層用プリント配線板を上記の内層用基材の両側に面積積層し、その外面を銅箔で挟んで、真空熱プレスにより加熱加圧成形を行い、外層用パターンをエッチングで形成して3層の試験用の多層プリント配線基板を得た。

【0034】(実施例2) 絶縁基材としてアラミド不織布にエポキシ樹脂を含浸させて作った多孔質基材であるアラミドエポキシコンポジットを用い、それにNCドリル貫通孔加工機で直径150 $\mu$ mの貫通孔をあけ導電性ペーストを充填しビアホールを形成後、銅箔で両側を挟み真空熱プレスにより加熱加圧成形し、内層用パターンをエッチングで形成し内層用配線板を得る。

【0035】同様に、NCドリル貫通孔加工機で直径150 $\mu$ mの貫通孔をあけ導電性を有したペーストを充填して外層用の絶縁基材を2枚形成し、これら外層用の配線板を上記の内層用配線板の両側に面接して積層し、表面を銅箔で挟みこみ真空熱プレスにより加熱加圧成形を

行い、外層用パターンをエッチングで形成し試験用の基板を得た。

【0036】(実施例3) 絶縁基材としてアラミド不織布にエポキシ樹脂を含浸させて作った多孔質基材を用い、それにエキシマレーザ加工機で直径200 $\mu$ mの貫通孔をあけた後、エポキシ樹脂ペーストを貫通孔に充填した。エポキシ樹脂の充填は半ねり状のエポキシ樹脂ペーストをスキージで貫通孔に詰め込む等の方法により行い、その後再度同じ位置に直径150 $\mu$ mの貫通孔をエキシマレーザで穿孔することにより貫通孔内壁に樹脂層を有した所望の直径の貫通孔を得る。次に、導電性ペーストを充填しビアホールを形成後、銅箔で両側を挟み真空熱プレスにより加熱加圧成形し、内層用パターンをエッチングで形成し内層用配線板を得る。

【0037】外層用として、上記の内層用配線板と同様にして、エポキシ樹脂ペーストを貫通孔に充填し、再度同じ位置に直径150 $\mu$ mの貫通孔をエキシマレーザで穿孔することにより貫通孔壁に樹脂層を有した貫通孔を設けた後、導電性ペーストを貫通孔に充填した外層用の配線板を形成した。外層用の配線板2枚を内層用配線板の両側に配し銅箔で挟みこみ真空熱プレスにより加熱加圧成形を行い、外層用パターンをエッチングで形成し試験用基板を得た。

【0038】(実施例4) 絶縁基材としてアラミド不織布にエポキシ樹脂を含浸させて作った多孔質基材であるアラミドエポキシコンポジットを用い、それにエキシマレーザ加工機等で直径180 $\mu$ mの貫通孔をあけ、樹脂溶液を貫通孔内壁部に塗布し樹脂層を形成し貫通孔を所望の直径にした後、導電性ペーストを充填しビアを形成後、銅箔で両側を挟み真空熱プレスにより加熱加圧成形し、内層用パターンをエッチングで形成し内層用の配線板を得る。

【0039】同様にして、外層用の配線板を得るために、エキシマレーザ加工機等で直径180 $\mu$ mの貫通孔をあけ、樹脂溶液を塗布することにより貫通孔内壁部に樹脂層を形成し貫通孔を所望の直径にした後、貫通孔に導電性ペーストを充填した絶縁基材を形成し、両側に配し銅箔で挟みこみ真空熱プレスにより加熱加圧成形を行い、外層用パターンをエッチングで形成し試験用の多層配線基板を得た。

【0040】(実施例5) 貫通孔内壁部に樹脂層を形成するために埋め込む樹脂としてフィラー入りのものを用いた他は実施例3と全く同様に試験用基板を作成した。フィラー材料としては無機物系の絶縁材料を樹脂材料に混合して使用した。また、フィラー材料を適切に選定し含有量を調整することにより、熱膨張係数を導電性ペーストとほぼ同じ値にしてある。

【0041】(実施例6) 貫通孔内壁部に樹脂層を形成するために埋め込む樹脂としてフィラー入りのものを用いた他は実施例4と全く同様に評価用基板を作成した。

フィラー材料としては無機物系の絶縁材料を樹脂材料に混合して使用した。また、フィラー材料を適切に選定し含有量を調整することにより、熱膨張係数を導電性ペーストとほぼ同じ値にしてある。

【0042】(比較例)比較例用として、アラミド不織布にエポキシ樹脂を含浸させて作った多孔質基材エキシマレーザ加工機で直径150 $\mu$ mの貫通孔をあけ導電性ペーストを充填しビアを形成後、銅箔で両側を挟み真空熱プレスにより加熱加压成形し、内層用パターンをエッチングで形成し内層用板を得、さらに同様に外層用板とを得た。

【0043】内層用板と外層用板との間で、プレスにより加熱加压成形を行い、外層用パターンをエッチングで形成し比較例の試験基板を得た。

【0044】本実施例および比較例にて作成した試験用基板を用いてビアホールと電気的な接続の信頼性およびビア間の耐マイグレーション性(絶縁性)を評価した。本発明のプリント配線板によって作成されるビアの電気的な接続信頼性の評価方法は次のように行う。

#### 【0045】(1)ビアホール接続抵抗

ビアの接続抵抗の評価方法はビア接続が直列に500個のチェーン配線を接続した抵抗測定により行う。ビア500個分の接続抵抗と配線抵抗の総和分を4端子測定法で求め、試験前後のビア抵抗値の変化量を求めるものである。信頼性試験として温度サイクル試験および半田ディップ(はんだ浸漬)試験、オイルディップ(油浸)試験を行った。

【0046】温度サイクル試験は気相中にて-55℃で30分放置し、後+125℃で30分放置を繰り返し1000回実施したとき、ビア接続抵抗の変化量で比較する。はんだディップ試験は、230℃に溶解したはんだ槽に10秒間漬けた後同様にビア接続抵抗の変化量を測定、比較する。

【0047】オイルディップ試験はオイルによる液相中の温度サイクル試験である。試験基板を高温260℃に加熱したオイル中に10秒間漬け、室温で10秒間保持し、さらに20℃のオイル中に10秒間漬ける。評価はこの温度サイクルを200回繰り返した後に行う。その時、高温側、低温側それぞれの漬けている時の抵抗を測定し200回の間断線がないことを確認し、200回後の抵抗値変化量を測定し比較する。

#### 【0048】(2)耐マイグレーション性試験

電気的に接続されている500ビアのチェーン配線を設け、そのすぐ隣に一定の間隔をおいて、電気的に接続されている500ビアのチェーン配線を設ける。それぞれのチェーン配線は接続されていない。これらのそれぞれの配線チェーンに+35Vの電位差を与え60℃95%の湿熱中に1000時間放置した後のそれぞれのチェーン配線間の抵抗値を比較測定した。これらの電気的な接続信頼性および耐マイグレーション性の評価結果を表1

に示す。

【0049】

【表1】

試験内容	抵抗値の変化量 $\Omega$			抵抗値 $\times 10^{13}$ $\Omega$
	温度サイクル	半田浸	油漬	
実施例1	0.40	0.52	0.46	3.7
実施例2	0.38	0.51	0.54	3.6
実施例3	0.39	0.50	0.51	4.0
実施例4	0.41	0.49	0.47	4.1
実施例5	0.30	0.31	0.34	8.1
実施例6	0.28	0.35	0.37	7.4
比較例1	1.85	2.87	3.08	1.3

【0050】表1に示すように本実施例のプリント配線板は比較例のプリント配線板に比べて接続抵抗値の変化量が小さいのが分かる。また耐マイグレーション性も良好なことが分かる。特に貫通孔内壁の樹脂層にフィラーを混合したものは電気的な接続信頼性が向上し絶縁抵抗値が高く耐マイグレーション性が向上しているのが分かる。本発明のプリント配線板では、貫通孔の内壁に樹脂層を形成することによりビアホール貫通孔内壁の状態を良好円滑にせしめ、ビアホールによる接続信頼性を高め、ビアホール接続不良、マイグレーションによる絶縁破壊等を起こさないようにすることができる。

#### 【0051】

【発明の効果】以上のように本発明のプリント配線板および製造方法は貫通孔の内壁に樹脂層を形成することにより多孔質基材を用いた場合でも、ビアホール貫通孔内壁の状態を良好にせしめ、導電性ペーストを貫通孔内部に確実に充填でき、ビアホールによる接続信頼性を高め、ビアホール接続不良、マイグレーションによる絶縁破壊等を起こさないようにすることができ、品質を大幅に向上させることができる。

#### 【図面の簡単な説明】

【図1】本発明の実施例のプリント配線板を説明するための部分縦断面図である。

【図2】多層プリント配線基板の部分縦断面図である。

【図3】従来のプリント配線板を説明するための部分縦断面図である。

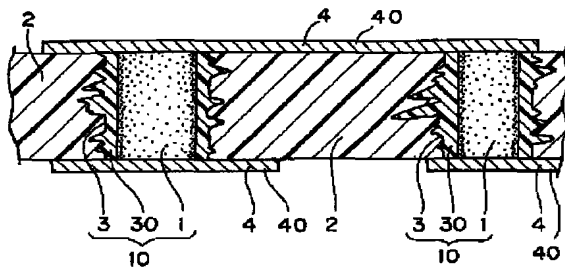
#### 【符号の説明】

- 1 ビアホール
- 10 貫通孔
- 2 絶縁基材
- 3 樹脂層

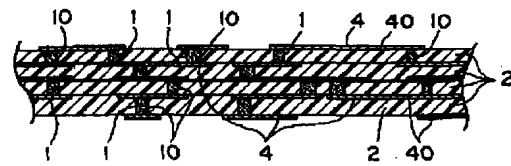
- 4 銅箔  
5 導電ペースト

- 6 導電ペーストしみこみ部

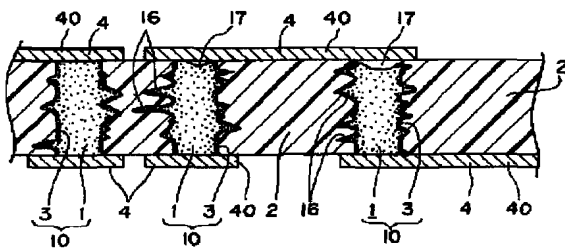
【図1】



【図2】



【図3】



フロントページの続き

(51)Int.Cl.<sup>6</sup>  
H05K 3/46

識別記号

F1  
H05K 3/46 X